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(54) Abstract Title: **A hair iron**

(57) The hair iron 10 comprises at least one platen or plate 14 which has a heating element 26 that is either printed, sintered or bonded thereon. The platen may be made of a ceramic composite, such as cordierite, and the heating element may be a metal alloy, such as a silver alloy, in a bonding matrix that is printed on to the platen, e.g. by screen printing. Alternatively the platen may be made of metal, glass or a glass-ceramic composite with insulated heating elements (40, Fig.6) bonded or sintered thereon. The material of the heating elements may be any material with low resistivity and high thermal coefficient of resistance so that temperature control is regulated by the characteristics of the material itself. The heating elements may be provided on the upper or lower side of the platen and may end in terminal pads connected to a battery within the device, or to the mains. The platens may have channels (24, Fig.3) for engagement with the fingers 12, 16, of the device. Alternative interchangeable platens with different shapes to straighten, curl or brush hair are also provided.

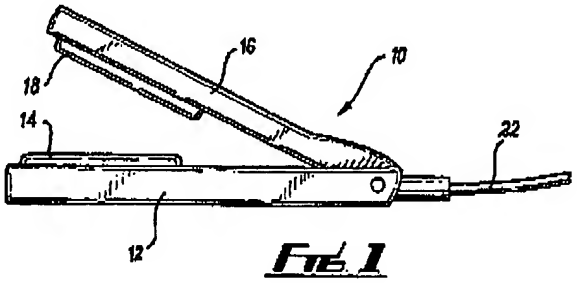

Fig.1

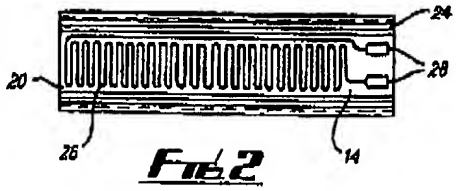

Fig.2

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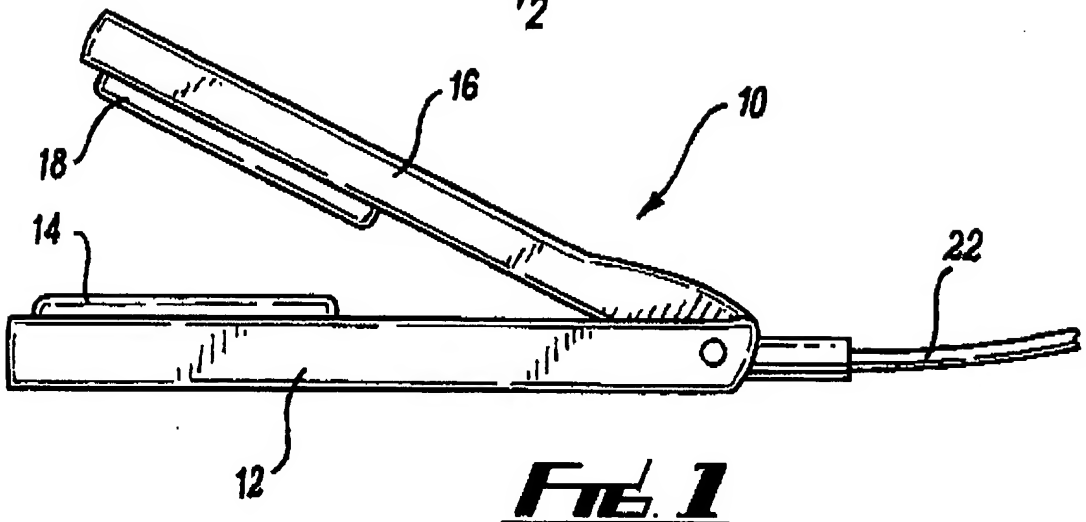

FIG. 1

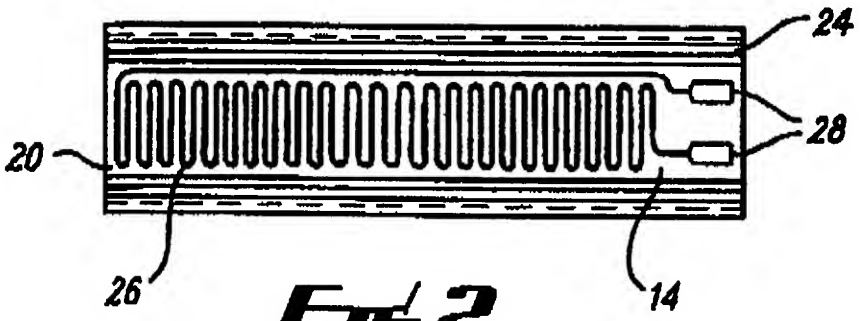

FIG. 2

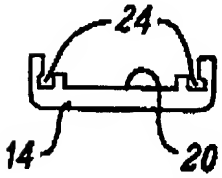

FIG. 3

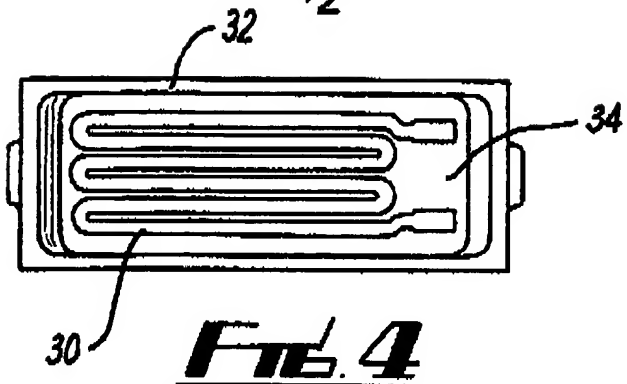

FIG. 4

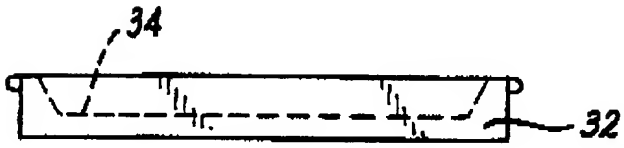

FIG. 5

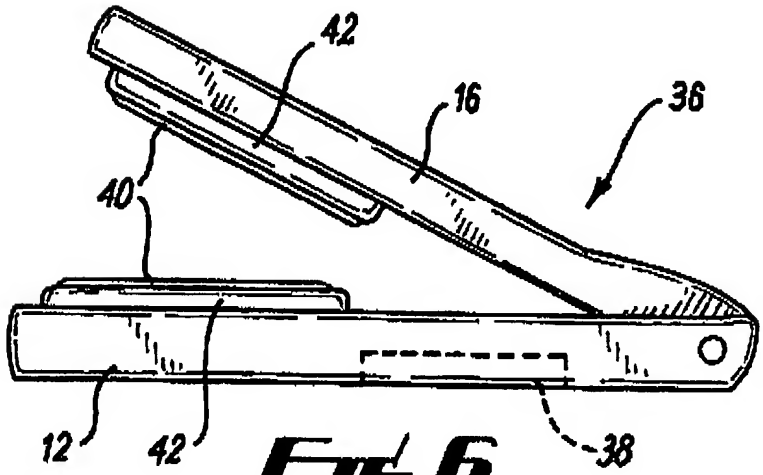

FIG. 6

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Hair Care Appliance

This invention concerns improvements in or relating to hair care appliances.

Hair care appliances such as straighteners are presently available but are generally not very efficient in operation. Accordingly, they may take a significant time to reach operating temperature, and also to return to operating temperature during use. As a result of this it has not been possible for a satisfactory battery operated version of such an appliance to be made.

According to the present invention there is provided a hair care appliance, the appliance having at least one heated platen, the platen having a heating element provided directly thereon.

The heating element may be provided on an upper side of the platen which can contact the hair, or on an underside of the platen.

The heating element may be printed on the platen, and may be applied by screen printing, transfer printing, or photolithography. Alternatively, the heating element may be formed on the platen by evaporation through a mask.

As a further alternative the heating element may comprise a discrete foil or wire, which element is bonded to the platen. The bonding may be provided by a glass, or low temperature sintered ceramic or cement.

The heating element preferably has a large temperature coefficient of resistivity, which may be in the range $2\text{-}6 \times 10^{-3}K^{-1}$.

The heating element may be made of any of tungsten, nickel, silver or platinum, which metal or metals may be in a glassy phase bonding matrix.

Alternatively the heating element may be non-metallic, could be silicon carbide.

The platen may be made of a ceramic material, which material may be cordierite. Alternatively, the ceramic material may be based on other compositions within the Al_2O_3 – MgO – SiO_2 system. A further possibility is that the ceramic material may be nitride based, for example aluminium or silicon nitride. As a further alternative the platen may be made from glass or glass-ceramic.

The ceramic material may have a low thermal expansion coefficient, and preferably has high thermal shock resistance. The thermal expansion coefficient is preferably in the range $0.1 - 8.0 \times 10^{-6}/°C$.

The thermal expansion coefficient of the ceramic material and heating element are preferably generally matched.

In an alternative embodiment the platen may be made of metal, for example by pressing.

The platen may be formed with a channel or recess, and the heating element may locate in the channel or recess.

The appliance may include two heated platens between which hair can be located.

The or each platen may be shaped to straighten, curl or brush hair. Interchangeable different shape platens may be provided.

The appliance may be mains or battery operated.

Terminal pads are preferably provided as part of the heating element to enable electrical connection to the heating element.

Embodiments of the present invention will now be described by way of example only and with reference to the accompanying drawings, in which:-

Fig. 1 is a diagrammatic side view of a hair care appliance according to the invention;

Fig. 2 is a diagrammatic view from beneath of a component of the appliance of Fig. 1;

Fig. 3 is a diagrammatic end view of the component of Fig. 2;

Fig. 4 is a diagrammatic view from beneath of an alternative component of the appliance of Fig. 1;

Fig. 5 is a diagrammatic side view of the component of Fig. 4; and

Fig. 6 is a similar view to Fig. 1 but of a second hair care appliance according to the invention.

Figs. 1 to 3 show a hair care appliance in the form of a hair straightening iron 10. The iron 10 comprises a first finger 12 which mounts a platen 14 thereon facing upwardly as shown in Fig. 1.

A second finger 16 is pivotally mounted to the first finger 12 and mounts a similar platen 18 which faces towards the platen 14 and can be moved theretowards by pivotal movement of the second finger 16.

The iron 10 is mains operated and a lead 22 is provided therefor. Each of the platens 14, 18 has a generally similar configuration and only the first

thereof will now be described. The platen 14 is made of a ceramic material which in this instance is cordierite and has a generally channel shaped profile with the channel 20 facing downwardly as shown in Fig. 1. Engagement formations 24 are provided in the channel corners to provide for mounting of the platen 14 to the finger 12.

A heating element 26 is provided within the channel. The heating element comprises a silver alloy in a glassy phase bonding matrix and is printed onto the platen 14 by screen printing. Two terminal pads 28 are provided at one end of the heating element 26 for connection to the electrical supply. The cordierite has a low thermal expansion (1×10^{-6}/°C) which is generally compatible with the thermal expansion of the silver alloy heating element. The cordierite also has high thermal shock resistance to prevent damage occurring thereto through regular heating up and cooling down. The heating element 26 has a large temperature coefficient of resistivity.

In use, power is supplied to the iron 10, and due to the large temperature coefficient of resistivity, and the good thermal contact between the respective heating element 20 and the platens 14, 18, the latter warm up quickly. Significant cooling of the platens take place when they come into contact with hair, but again due to the large temperature coefficient of resistivity the platens rapidly return to a required working temperature, since there is a significant reduction in resistivity with temperature loss.

Figs. 4 and 5 show an alternative heating element 30 and platen 32 arrangement. In this instance a recess 34 is provided on the underside of the platen 32 in which the heating element 30 is located, by for instance printing, painting or bonding. As can be seen the heating element 30 has a different configuration to the heating element 26, but both are configured to provide good heat transfer right across the respective platens 14, 18, 32.

Fig. 6 shows a further iron 36 according to the invention. The iron 36 is similar to the iron 10 except as follows. In this instance the iron 36 is battery operated and a battery pack 38 is provided within the first finger 12. The battery pack 38 can take any appropriate form and may include rechargeable or disposable batteries.

In this instance the platens are formed of metal, and are shaped by pressing. The heating elements 40 are provided on the top surface of the platens 42. The heating elements 40 may have a similar arrangement to the heating elements 26, but a conformal dielectric insulating layer is provided on the heating elements 40. In an alternative arrangement (not shown) the heating elements can be provided on the underside of the platens as in the iron 10.

In use, the iron 36 will operate similarly to the iron 10. Locating the heating elements 40 on the outer surfaces of the platens 42 provides for greater heat transfer and thus in general a lower power usage. Accordingly, with the good heat transfer between the heating elements and platens, and with the relatively low power input required to heat the platens to a required heating temperature and also to return the platens to this temperature following cooling, the iron 36 can operate satisfactorily whilst still being battery powered.

Various other modifications may be made without departing from the scope of the invention. For instance, a different ceramic material may be used and this could be based on any combination of components in the $Al_2O_3 - MgO - SiO_2$ system. Alternatively a nitride base material such as aluminium or silicon nitride, or a glass or glass-ceramic could be used. To operate satisfactorily the platen material should have a low expansion coefficient, preferably within the range 0.1 – 8.0 x 10^{-6}/°C, and also have a high thermal shock resistance.

The heating element could be transfer printed, or printed using photolithography. Alternatively the heating element could be formed by evaporation through a mask. The heating element may be in the form of a discrete foil or wire which can be bonded to the platen, perhaps by a glass or low temperature sintered ceramic or cement. The battery pack could be located elsewhere.

The heating element may be made of a different material and could be made for instance of tungsten, nickel or platinum. The element can be made of any material with a sufficiently low resistivity and high thermal coefficient of resistance such that the temperature control can be effected by the material's natural increase in resistance as a function of increasing temperature. As indicated the heating elements may be provided on the top or underside of the platen as required.

The platen may take a different shape and could be shaped for instance to curl or brush hair. The irons may be arranged such that the platens are interchangeable so different shape platens can be selected as required.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

CLAIMS

1. A hair care appliance, the appliance having at least one heated platen, the platen having a heating element provided directly thereon.

2. An appliance according to claim 1, in which the heating element is provided on an upper side of the platen which can contact the hair.

3. An appliance according to claim 1, in which the heating element is provided on an underside of the platen.

4. An appliance according to any of the preceding claims, in which the heating element is printed on the platen.

5. An appliance according to claim 4, in which the heating element is applied by screen printing, transfer printing, or photolithography.

6. An appliance according to any of claims 1 to 3, in which the heating element comprises a discrete foil or wire, which element is bonded to the platen.

7. An appliance according to claim 6, in which the bonding is provided by a glass.

8. An appliance according to claim 6, in which the bonding is provided by a low temperature sintered ceramic.

9. An appliance according to claim 6, in which the bonding is provided by a cement.

10. An appliance according to any of the preceding claims, in which the heating element preferably has a large temperature coefficient of resistivity.

11. An appliance according to claim 10, in which the heating element has a temperature coefficient of resistivity in the range 2-6 x $10^{-3}K^{-1}$.

12. An appliance according to any of the preceding claims, in which the heating element is made of any of tungsten, nickel, silver or platinum.

13. An appliance according to claim 12, in which the metal or metals of the heating element is in a glassy phase bonding matrix.

14. An appliance according to any of claims 1 to 11, in which the heating element is non-metallic.

15. An appliance according to claim 14, in which the heating element is made of silicon carbide.

16. An appliance according to any of the preceding claims, in which the platen is made of a ceramic material.

17. An appliance according to claim 16, in which the platen is made of cordierite.

18. An appliance according to claim 16, in which the ceramic material is based on compositions within the Al_2O_3 – MgO – SiO_2 system.

19. An appliance according to claim 16, in which the ceramic material is nitride based, for example aluminium or silicon nitride.

20. An appliance according to any of claims 16 to 19, in which the ceramic material has a low thermal expansion coefficient.

21. An appliance according to claim 20, in which the ceramic material has a thermal expansion coefficient in the range 0.1 – 8.0 x 10^{-6}/°C.

22. An appliance according to claims 20 or 21, in which the thermal expansion coefficient of the ceramic material and heating element are generally matched.

23. An appliance according to any of claims 16 to 22, in which the ceramic material has high thermal shock resistance.

24. An appliance according to any of claims 1 to 15, in which the platen is made from glass.

25. An appliance according to any of claims 1 to 15, in which the platen is made from glass-ceramic.

26. An appliance according to any of claims 1 to 15, in which the platen is made from metal.

27. An appliance according to claim 26, in which the platen is made by pressing.

28. An appliance according to any of the preceding claims, in which the platen is formed with a channel or recess.

29. An appliance according to claim 28, in which the heating element locates in the channel or recess.

30. An appliance according to any of the preceding claims, in which the appliance includes two heated platens between which hair can be located.

31. An appliance according to any of the preceding claims, in which the or each platen is shaped to straighten, curl or brush hair.

32. An appliance according to any of the preceding claims, in which interchangeable different shape platens are provided.

33. An appliance according to any of the preceding claims, in which the appliance is mains operated.

34. An appliance according to any of claims 1 to 32, in which the appliance is battery operated.

35. An appliance according to any of the preceding claims, in which terminal pads are provided as part of the heating element to enable electrical connection to the heating element.

36. A hair care appliance substantially as hereinbefore described and with reference to Figs. 1 to 3 of the accompanying drawings.

37. A hair care appliance substantially as hereinbefore described and with reference to Figs. 4 and 5 of the accompanying drawings.

38. A hair care appliance substantially as hereinbefore described and with reference to Fig. 6 of the accompanying drawings.

39. Any novel subject matter or combination including novel subject matter disclosed herein, whether or not within the scope of or relating to the same invention as any of the preceding claims.

Application No: GB0418981.7 **Examiner:** Mr Pablo Cappellini

Claims searched: 1-38 **Date of search:** 26 November 2004

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,Y	X:1-6,9,12,13,16,17, 19, 22, 23, 26, 30,33 & 35;Y:18,20 & 21	US 6367155 B2 (HOMANN) - See whole document. Note printed heating element 7 and claims 1, 4, 6 & 12.
X	1-3, 28, 29 & 31-35	GB 2021943 A (BRAUN) - See all figures. Note heating element 18 on platen 14.
X	1, 2, 10, 11, 14, 27, 31 & 33-35	US 4354092 A (MANABE et al) - Note heater element 17 on platen 9.
X	1, 3 & 28-33	US 4739151 A (SMAL) - See whole document. Note heating element recesses 4.1 and 5.1 and platens 4-7.
X	1-3, 31, 34 & 35	US 6009884 A (SUH) - Note rod 22 which can be considered as a platen and heating element 21.
Y	1-5, 12-14, 16, 30, 31 & 33	ES 2112149 A1 (GONZALEZ ORTEGO) - Note heating element 3, 4, 7 on base surface 1.
Y	1-5, 12-14, 16, 30, 31 & 33	JP 11075927 A (SONODA) - Note heating elements 7a, 7b in platens 6.
Y	18, 20 & 21	JP2000054090 A (HAYASHI et al) - See whole document.

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Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{W} :

A4V

Worldwide search of patent documents classified in the following areas of the IPC^{07}

A45D

The following online and other databases have been used in the preparation of this search report

ONLINE: EPODOC, WPI, JAPIO